

Course guide

205164 - 205164 - Advances in Fibres and Yarns

Last modified: 04/05/2026

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 702 - CEM - Department of Materials Science and Engineering.

Degree: MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2025). (Optional subject).

Academic year: 2026 **ECTS Credits:** 5.0 **Languages:** English

LECTURER

Coordinating lecturer: Coordinador: Monica Ardanuy

Others: Tornero García, José Antonio
Cano Casas, Francesc

LEARNING RESULTS

Knowledges:

KTX1. Understand textile product design methods (specialisation in Textile Design and Technology).

Skills:

STX1. Develop textile design projects (specialisation in Textile Design and Technology).

Competences:

C03. Develop innovative products, processes and methods in the field of industrial engineering.

TEACHING METHODOLOGY

The teaching methodology is based on:

- Face-to-face sessions of presentation of the contents and problem-solving exercises.
- Face-to-face laboratory work sessions.
- Autonomous work of study and realization of exercises and activities.

In the sessions of presentation-participation of the contents, the professor will introduce the theoretical bases of the matter, concepts, methods and results illustrating them with convenient examples and requesting, if necessary, the realization of exercises, to facilitate his comprehension.

In the laboratory work sessions, the teacher will guide the students in the application of the theoretical concepts for the resolution of experimental questions, based at all times on critical reasoning. Activities will be proposed that the student solves in the classroom and outside the classroom, to favor the contact and use of the basic tools necessary for the realization of an instrumentation system. Students, autonomously, have to work on the material provided by the teachers and the result of the work-problem sessions to assimilate and fix the concepts. Teachers will provide a study and activity monitoring plan (ATENEA).

LEARNING OBJECTIVES OF THE SUBJECT

At the end of the course, the student must be able to:

- To know the most important characteristics and properties of the latest developments related to fibers, yarns, and fabrics for applications in textiles for technical use.
- Understand and characterize textile materials according to technical and quality criteria.

STUDY LOAD

Type	Hours	Percentage
Hours small group	15,0	12.00
Hours large group	30,0	24.00
Self study	80,0	64.00

Total learning time: 125 h

CONTENTS

Lesson 1: Introduction and general considerations on advances in textile fibers

Description:

1.1. Introduction to advances in textile fibers: general classification of fibers, production processes, chemical composition, and morphology and properties

Related activities:

- AF1. Theoretical work sessions in the classroom
- AF4. Preparation and performance of assessable individual or group activities
- AF5. Autonomous study work and exercises
- AF6. Tutoring and formative evaluation of the learning process

Full-or-part-time: 2h

Theory classes: 1h

Self study : 1h

Lesson 2: High performance fibers

Description:

- 2.1. Introduction to high-performance fibers
- 2.2. High modulus and toughness fibers: Polyethylene HP, Polyamide HP, Polyester, HP and others
- 2.3. Heat-resistant fibers: aramids, polybenzoxazoles, other organic polymer fibers, thermoset polymer fibers, carbon fibers, glass fibers, metal fibers, ceramics and others
- 2.4. Flame retardant fibers

Related activities:

- AF1. Theoretical work sessions in the classroom
- AF2. Resolution of exercises, problems and cases, possibly with computer support, with the participation of the student in the classroom
- AF3. Practical work sessions in the laboratory
- AF4. Preparation and performance of assessable individual or group activities
- AF5. Autonomous study work and exercises
- AF6. Tutoring and formative evaluation of the learning process

Full-or-part-time: 30h

Theory classes: 8h

Laboratory classes: 2h

Self study : 20h

Lesson 3: Recycled fibres

Description:

- 3.1. Introduction to fiber recycling
- 3.2. Mechanical recycling
- 3.3. Thermomechanical recycling
- 3.4. Chemical recycling
- 3.5. Other types of fiber recycling

Related activities:

- AF1. Theoretical work sessions in the classroom
- AF2. Resolution of exercises, problems and cases, possibly with computer support, with the participation of the student in the classroom
- AF3. Practical work sessions in the laboratory
- AF4. Preparation and performance of assessable individual or group activities
- AF5. Autonomous study work and exercises
- AF6. Tutoring and formative evaluation of the learning process

Full-or-part-time: 10h

Laboratory classes: 6h

Self study : 4h

Lesson 4: Fibers based on biopolymers

Description:

- 4.1. Introduction to biopolymers
- 4.2. Fibers obtained from polymers from biomass: based on polysaccharides or proteins
- 4.3. Fibers obtained from monomers from biomass
- 4.4. Bast fibers
- 4.5. Other biofibers

Related activities:

- AF1. Theoretical work sessions in the classroom
- AF2. Resolution of exercises, problems and cases, possibly with computer support, with the participation of the student in the classroom
- AF3. Practical work sessions in the laboratory
- AF4. Preparation and performance of assessable individual or group activities
- AF5. Autonomous study work and exercises
- AF6. Tutoring and formative evaluation of the learning process

Full-or-part-time: 12h

Laboratory classes: 2h

Self study : 10h

Lesson 5: Introduction to technical yarns

Description:

5.1. Introduction to yarns for technical applications: classification according to performance criteria, functionality, structure and manufacturing process

Related activities:

AF1. Theoretical work sessions in the classroom

AF2. Resolution of exercises, problems and cases, possibly with computer support, with the participation of the student in the classroom

AF3. Practical work sessions in the laboratory

AF4. Preparation and performance of assessable individual or group activities

AF5. Autonomous study work and exercises

AF6. Tutoring and formative evaluation of the learning process

Full-or-part-time: 11h

Theory classes: 3h

Laboratory classes: 1h

Self study : 7h

Lesson 6: Innovation in technical application threads

Description:

6.1. Evolution of threads for technical applications, conductive threads, High Modulus, High Tenacity Yarns, hybrid and composite threads, threads for medical application (suture), biodegradable threads, fancy, coated threads, threads of novel materials.

6.2. Innovations and latest trends in the development of yarns for technical use

Related activities:

AF1. Theoretical work sessions in the classroom

AF2. Resolution of exercises, problems and cases, possibly with computer support, with the participation of the student in the classroom

AF3. Practical work sessions in the laboratory

AF4. Preparation and performance of assessable individual or group activities

AF5. Autonomous study work and exercises

AF6. Tutoring and formative evaluation of the learning process

Full-or-part-time: 35h

Theory classes: 9h

Laboratory classes: 4h

Self study : 22h

Lesson 7: Production processes of the threads of technical application

Description:

- 7.1. Production processes for threads of technical application, coating processes, hair modification, structure obtained, production of thin threads and new materials
- 7.2. Thread development techniques for technical applications with improved properties or new functionalities
- 7.3. Characterization and quality in threads for technical applications, tests and regulations

Related activities:

- AF1. Theoretical work sessions in the classroom
- AF2. Resolution of exercises, problems and cases, possibly with computer support, with the participation of the student in the classroom
- AF3. Practical work sessions in the laboratory
- AF4. Preparation and performance of assessable individual or group activities
- AF5. Autonomous study work and exercises
- AF6. Tutoring and formative evaluation of the learning process

Full-or-part-time: 25h

Theory classes: 9h

Self study : 16h

GRADING SYSTEM

Exam 1: 20%

Exam 2: 20%

Exercises and practical cases: 30%

Reports of laboratory work: 30%.

For those students who meet the requirements and take the reevaluation exam, the grade of the reevaluation exam will substitute the marks of all the evaluation acts that are face-to-face written tests (controls, midterms and final exams) and the practical grades will be maintained: laboratory reports, exercises and presentations obtained during the course.

If the final grade after the reevaluation is lower than 5.0, it will replace the initial one only if it is higher. If the final grade after the reevaluation is greater than or equal to 5.0, the final grade for the course will be 5.0.

BIBLIOGRAPHY

Basic:

- Hearle, J.W.S. High-performance fibres. Cambridge: Boca Raton: Woodhead; CRC, cop. 2001. ISBN 1855735393.
- Hongu, Tatsuya; Phillips, Glyn O.; Takigami, Machiko. New millennium fibers. Boca Raton [etc.]: Woodhead/CRC, cop. 2005. ISBN 1855736012.
- Horrocks, A.R.; Anand, S. Handbook of technical textiles [on line]. 2nd ed. Cambridge UK: Woodhead Publishing; Textile Institute, 2016 [Consultation: 04/11/2022]. Available on: <https://www.sciencedirect-com.recursos.biblioteca.upc.edu/book/9781782424581/handbook-of-technical-textiles>.
- Bunsell, A. R. Handbook of tensile properties of textile and technical fibres. Cambridge: Boca Raton: Woodhead; CRC, 2009. ISBN 9781845693879.
- Brown, P. J; Stevens, K. Nanofibers and nanotechnology in textiles. Boca Raton [etc.]: Cambridge: CRC; Woodhead, 2007. ISBN 9781845691059.
- Blackburn, R. S. Biodegradable and sustainable fibres. Boca Raton, (etc.): CRC: Woodhead publishing limited, cop. 2005. ISBN 185573916X.
- Alagirusamy, R; Das, A. Technical textile yarns: industrial and medical applications. Boca Raton, FL: Oxford: CRC Press; Woodhead Publishing Limited, cop. 2010. ISBN 9781845695491.

RESOURCES

Other resources:

ALGUNES WEBS D'INTERÈS:

- <http://www.innovationintextiles.com> />- <http://www.techtextil.com/>